Chemistry 129.01 Quiz #3: 25 points

Name: Key

Show all your work!

1. (2 pts) Are the following sets of quantum numbers allowed?

   a) $n = 3, l = 2, m_l = 0$ Yes

   b) $n = 2, l = -1, m_l = 1$ No

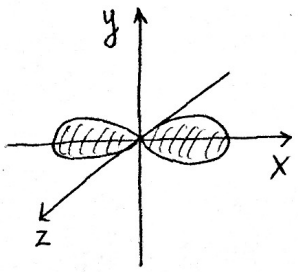
2. (3 pts) What is the maximum number of electrons in an atom that can have the following quantum numbers?

   a) $n = 2, \ l = 1$ 6

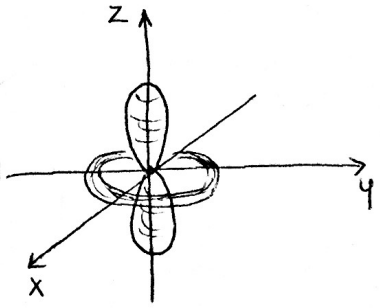
   b) $n = 4, \ l = 2, \ m_s = ½$ 5

   c) $n = 3, \ m_s = ½$ 9

3. (4 pts) Draw the following orbitals: p_x and d_{z2}



P_x



dz^2

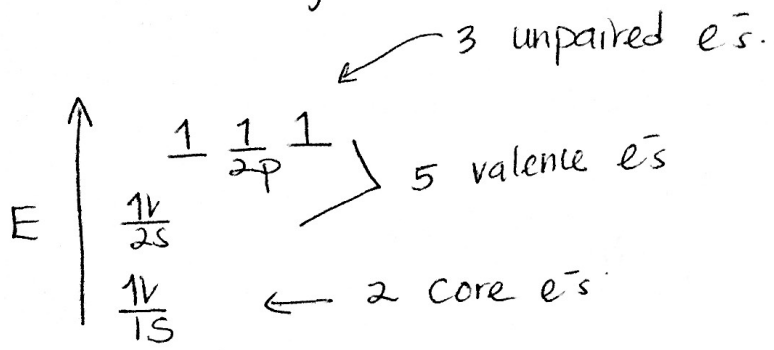
4. (4 pts) Write the **full** electron configuration of the following:

   a) F^- $10e^-$s $1s^2 2s^2 2p^6$

   b) V $23e^-$s $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$

5. (6 pts) Draw the **atomic orbital energy diagram** of the element with atomic number **7**. How many core electrons, valence electrons and unpaired electrons does it have?

$Z = 7 \Rightarrow$ nitrogen

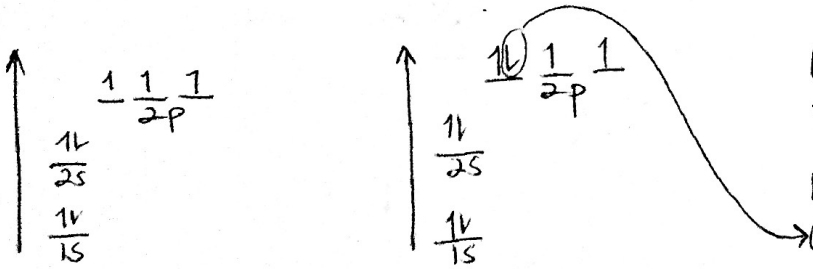


6. (6 pts.) (a) Arrange the following elements in order of **increasing** atomic radius:

Ne, F^-, Ga, Cs^+, F, Cs.

$$Ne < F < F^- < Ga < Cs^+ < Cs$$

(b) What is the first ionization trend as we go down/across periodic table? The first ionization energy of nitrogen is higher than that for oxygen. Explain why.



Oxygen's ionization energy is lower than that of nitrogen because removing one e^- from it would reduce the $e^- - e^-$ repulsions of two e⁻s sharing the same orbital and would get a stable half-full 2p subshell.